APPENDIX A

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[DOCUMENT TITLE] scope of claim for patent
[Claim 1]
An image data collection system comprising:
an image data collecting means configured to collect image data from an object to be examined;
a heart rate recording means configured to measure a temporal change of heart rate of the object after a prescribed action and recording the measured heart rate;
a resolution predicting means configured to predict a temporal change of resolution in the image data after the prescribed action based on the temporal change of heart rate recorded by the heart rate recording means;
a site of interest designating means for designating a site of interest in the object; and
an image data collection controlling means configured to adjust an image data collecting position of the image data collecting means to make the site of interest as a target of the image data collecting at a suitable time for collecting the image data when the time resolution predicted by the time resolution predicting means is in a desired range.

[Claim 2]
The image data collection system according to claim 1, characterized in further comprising:
a projected image obtaining means configured to obtain a projected image of the object;
display controlling means configured to display the projected image and a marker that indicates an estimated site set as the target for controlling image data at a suitable time for collecting the image data on the display means; and
an operating means for an operator to input a command to relatively move the projected image and the marker on the display means,

wherein, when the command is inputted, the display controlling means displays the projected image and the marker while moving them relatively on the display means according to the command, and the site of interest designating means designates the site of the object corresponding to the position of the marker as the site of interest on the projected image after the relative moving.

[Claim 3]

The image data collection system according to claim 2, characterized in further comprising:

a resolution graph creating means configured to create a resolution graph that indicates a temporal change of the resolution on coordinates defined by a time axis and a resolution axis;

wherein the display controlling means superimposes the resolution graph with the projected image on the display means, and adjusts relative position, direction and scale of the projected image and the time axis on the display means such that a time at which the site of the object equivalent to the position of a point in the resolution graph on the projected image is to be set as the target of the image data collecting corresponds with a time equivalent to the coordinates of the point on the time axis in a plurality of points on the resolution graph.

[Claim 4]

The image data collection system of any one of claims 1-3, wherein the prescribed action is the start of breath holding by the object.

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[DOCUMENT TITLE] SPECIFICATION

[TITLE OF INVENTION] IMAGE DATA COLLECTION SYSTEM

[TECHNICAL FIELD]

[0001] The present invention relates to an image data collection system and particularly relates to an image data collection system which reduce motion artifact caused by a heartbeat in a cardiac area.

[BACKGROUND ART]

[0002]When image data is collected from the heart area of an object to be examined and an image is reconstructed based on the data, the image quality is degraded by cardiac motion artifact caused by a heartbeat and respiratory motion artifact caused by a thorax motion associated with respiration.

[0003]Conventionally, a scanning method called electrocardiographic synchronous scanning or ECG (electro cardio gram) is available in which electrocardiographic data is obtained to reduce heartbeat motion artifact, and then image data is collected and an image is reconstructed based on the data in synchronization with a heartbeat or with a phase shift relative to a heartbeat (for example, Patent document 1). For example, according to segment reconstruction which is a kind of cardiographic synchronous scanning, based on cardiographic data recorded with image data, image data collected in a diastole during which cardiac motions are relatively few is extracted and an image is reconstructed according to the data, so that an image can be obtained with a preferable time resolution and less cardiac motion artifact. During the collection of image data, image data collection conditions such as a scanning speed are set and fixed according to the heart rate of an object to be examined. Thus it is desirable to stabilize the heart rate to keep the high quality of an obtained image.

[0004]In order to prevent respiratory motion artifact, the object is generally caused to hold his/her breath to prevent a thorax motion during the collection of image data.

[Patent document 1] Japanese Patent Application Laid-Open No. 2000-189412

[DISCLOSURE OF THE INVENTION]

[Problems to be Solved]

[0005]However, in many cases, when the object holds his/her breath, the heart rate tends to fluctuate more than a resting pulse rate. Although fluctuations in heart rate due

to breath holding vary among individuals, the fluctuations vary, in any event, the time resolution of an image obtained in cardiographic synchronous scanning. For example, in the case of image data collection conditions set suitably for a resting heart rate, when the heart rate during the collection of image data is almost equal to the resting heart rate, an image obtained under the image data collection conditions has a preferable and constant time resolution. In reality, however, the heart rate during the collection of image data deviates from the resting heart rate, and thus a satisfactory image cannot be obtained under image data collection conditions suitable for the resting heart rate.

[0006]The present invention is devised in view of such circumstances. An object of the present invention is to provide an image data collection system whereby preferable image data can be obtained even when the heart rate of an object to be examined fluctuates during the collection of image data.

[Means to Solve the Problems]

[0007] In order to attain the object, an image data collection system according to the present invention is comprising: an image data collecting means configured to collect image data from an object to be examined, a heart rate recording means configured to measure a temporal change of heart rate of the object after a prescribed action and recording the measured heart rate, a resolution predicting means configured to predict a temporal change of resolution in the image data after the prescribed action based on the temporal change of heart rate recorded by the heart rate recording means, a site of interest designating means for designating a site of interest in the object; and an image data collection controlling means configured to adjust an image data collecting position of the image data collecting means to make the site of interest as a target of the image data collecting at a suitable time for collecting the image data when the time resolution predicted by the time resolution predicting means is in a desired range.

[0008] Preferably, the image data collection system is further comprising: a projected image obtaining means configured to obtain a projected image of the object, display controlling means configured to display the projected image and a marker that indicates an estimated site set as the target for controlling image data at a suitable time for collecting the image data on the display means; and an operating means for an operator to input a command to relatively move the projected image and the marker on the display means, wherein, when the command is inputted, the display controlling means displays the projected image and the marker while moving them relatively on the

display means according to the command, and the site of interest designating means designates the site of the object corresponding to the position of the marker as the site of interest on the projected image after the relative moving.

[0009] Furthermore, the image data collection system is further comprising: a resolution graph creating means configured to create a resolution graph that indicates a temporal change of the resolution on coordinates defined by a time axis and a resolution axis, wherein the display controlling means superimposes the resolution graph with the projected image on the display means, and adjusts relative position, direction and scale of the projected image and the time axis on the display means such that a time at which the site of the object equivalent to the position of a point in the resolution graph on the projected image is to be set as the target of the image data collecting corresponds with a time equivalent to the coordinates of the point on the time axis in a plurality of points on the resolution graph.

[0010] An example of the prescribed action is the start of breath holding by the object.

[Effect of the Invention]

[0011]According to the present invention, changes of heart rate of an object are estimated during the collection of image data, and the collection of image data is controlled accordingly, so that image data can be collected.

[BEST MODE FOR CARRYING OUT THE INVENTION]

[0012]The following will describe preferred embodiments of an image data collection system of the present invention in accordance with the accompanying drawings.

[0013]FIG. 1 is a schematic structural diagram showing an image data collection system according to an embodiment of the present invention. As shown in FIG. 1, the image data collection system 10 is mainly made up of a scanner 20 for collecting scanning data from an object to be examined 1, and a controller 50 for controlling the overall image data collection system 10 and the arithmetic operations of data having been collected by the scanner 20.

[0014]The scanner 20 can be any type as long as scanning data is collected from the object 1. Devices using X-rays, infrared rays, ultrasonic waves, nuclear magnetic resonance, positron emission, irradiation from a radioisotope, and so on are generally

used. The following will discuss an X-ray CT apparatus as an example.

[0015]The scanner 20 mainly includes an X-ray generator 22 for generating X-rays, an object table 24 on which the object 1 is laid, an object table moving device 26 for moving the object table 24 along the body axis (hereinafter, simply will be referred to as "body axis"), an X-ray detector 28 for detecting X-rays having passed through the object 1, a scanner rotating device 32 for continuously rotating, about the body axis, a scanner body 30 including the X-ray generator 22 and the X-ray detector 28, and an electrocardiographic data acquisition device 36 for acquiring electrocardiographic data on the object 1 through electrocardiographic electrodes 34 making contact with the body surface of the object 1.

[0016]The controller 50 mainly includes a CPU 52 for controlling the overall image data collection system 10, a scanner control unit 54 for controlling the scanner 20, an image data processing unit 56 for processing image data having been obtained by the X-ray detector 28, an electrocardiographic data processing unit 58 for processing electrocardiographic data having been obtained by the electrocardiographic data acquisition device 36, a data recorder 60 for storing various kinds of data, a display 62 for displaying various images, an operation part 64 including a pointing device such as a keyboard, a mouse, and a trackball and input means such as a touch panel, and a bus 66 for mediating data transmission and reception of the units in the image data collection system 10. The data recorder 60 may be a memory included or installed outside the controller 50, a storage device such as a magnetic disc, a device for writing and reading data on removable external media, and a device for transmitting and receiving data through an external storage device and a network, and so on. The data recorder 60 stores, in the CPU 52, a program for controlling the image data collection system 10.

[0017]FIG. 2 is a flowchart showing the flow of a series of cardiac area scanning examinations conducted by the image data collection system 10 of the present embodiment. First, the object 1 is laid on the object table 24 and the scanning examination is started (S200). The electrocardiographic electrodes 34 are attached to the body surface of the object 1 to obtain electrocardiographic data on the object 1 (S202).

[0018]In order to prevent respiratory motion artifact, the object 1 has to hold his/her breath during the collection of image data. Thus the object 1 practices holding his/her breath before the collection of image data. In order to allow the object 1 to stably hold

his/her breath as long as possible, the object 1 preferably inhales air with a high content of oxygen (S204) beforehand. This step may be omitted in some cases. After that, the object 1 is caused to hold his/her breath (S206); meanwhile the electrocardiographic data acquisition device 36 acquires, through the electrocardiographic electrodes 34, electrocardiographic data including the electrocardiographic waveform and heart rate of the object 1 (S208). The obtained electrocardiographic data is processed by the electrocardiographic data processing unit 58 and recorded in the data recorder 60.

[0019]At the completion of the practice of holding his/her breath (S210), a projected image of the object 1 is acquired (S212). Then, based on the electrocardiographic data having been obtained in S208 during the practice of holding his/her breath and the projected image having been obtained in S212, image data collection conditions are set which include an elapsed time (called delay time) from a start time of breath holding to a start time of image data collection, a starting position of image data collection, an end position of image data collection, a scanning speed, and an amount of the movement of the object table (S214). The conditions may be automatically set by the CPU 52 according to a predetermined program or set by an operator by means of the display 62 and the operation part 64 serving as an interface.

[0020]As a preparation to breath holding of the object 1 during the collection of image data, the object 1 preferably inhales air with a high oxygen concentration (S216). This step is preferably performed in a similar manner to S204. When S204 is omitted, it is preferable to omit S216 as well. After that, the object 1 is caused to hold his/her breath (S218). The CPU 52 controls the scanner 20 through the scanner control unit 54, starts collecting image data according to the image data collection conditions having been set in S214 (S220), collects the image data on the object 1, obtains electrocardiographic data, and records the data in the data recorder 60. At the completion of the collection of image data (S222), the object 1 is caused to stop holding his/her breath (S224).

[0021]Since a setting may be made in S216 so as to collect image data in several times, the CPU 52 decides whether the scanning examination should be completed or not (S226). When the scanning examination is not completed and image data is repeatedly collected, it is preferable to allow the object 1 to take a rest, before returning to S216, to restore his/her physical condition including a heart rate to the resting condition (S228).

[0022]When it is decided in S226 that the scanning examination should be completed,

the image data processing unit 56 and the electrocardiographic data processing unit 58 reconstruct the image based on the obtained image data and electrocardiographic data (S230) and record the image in the data recorder 60, so that the series of examinations is completed (S232).

[0023]Some of the steps in FIG. 2 will be discussed below in detail.

[0024]First, the acquisition of electrocardiographic data during the practice of holding breath (S208) will be discussed below. In S208, for example, data is obtained as shown in FIG. 3 which indicates fluctuations in the heart rate of the object 1 with time from the start of the practice of holding breath (S206). In the example of FIG. 3, the heart rate is about 64 (beats/minute) at the start time of the practice of holding breath. With the lapse of breath holding time, the heart rate increases. The heart rate reaches about 89 after 30 seconds from the start of the practice of holding breath. The tendency of fluctuations in heart rate due to breath holding greatly vary among individuals, and the heart rate does not always increase in a monotonous manner but may decrease or fluctuate with the lapse of breath holding time. The electrocardiographic data processing unit 58 may have the function of estimating fluctuations in heart rate, for example, from 30 to 40 seconds of breath holding time based on data on fluctuations in heart rate until 30 seconds from the start of the practice of holding breath, according to a technique such as a linear approximation method. Further, the tendency of fluctuations in heart rate with the lapse of breath holding time may be recognized with higher accuracy by repeating the steps of S204 to S210 several times and determining an average of the obtained data on fluctuations in heart rate with time.

[0025]The following will discuss the setting of the image data collection conditions based on the electrocardiographic data during the practice of holding breath (S214). FIG. 4 illustrates fluctuations in the time resolution of an image obtained by electrocardiographic synchronous scanning, relative to the image data collection conditions and the heart rate. FIG. 4 is a graph showing the relationship between the heart rate and the time resolution of an image when electrocardiographic synchronous scanning is performed using multislice CT according to segment reconstruction, in which two kinds of scan time are combined. In a range represented as A in FIG. 4, an image is reconstructed with scan time A. In a range represented as B in FIG. 4, an image is reconstructed with scan time B. The number of kinds of scan time is not limited to two. One or three or more kinds of scan time may be used.

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[0026]For example, when the heart rate is 65, scan time B is more suitable than scan time A. An image obtained by segment reconstruction with scan time B has a time resolution of about 150 ms. A heart rate even slightly larger than 65 reduces the time resolution (the numeric value increases). When the heart rate is 68, an image obtained in scan time B has a time resolution of about 270 ms. When the heart rate is larger than 68, an image obtained in scan time B further decreases in time resolution and an image obtained by image reconstruction in scan time A has a higher time resolution. Moreover, when the heart rate is larger than 83, scan time B is more suitable than scan time A. In this way, the time resolution of an image greatly varies with the heart rate.

[0027]In the following explanation, regarding the object 1 whose heart rate fluctuates with time as shown in FIG. 3 from the start of the practice of holding breath, electrocardiographic synchronous scanning is performed by segment reconstruction according to the relationship of FIG. 4 between the heart rate and the time resolution of an image. It is estimated from FIG. 3 that during the collection of image data, for example, the heart rate is about 64 at 0 seconds of breath holding time, that is, at the start time of breath holding, and the heart rate is about 74 at 10 seconds of breath holding time. As shown in FIG. 4, an image has a time resolution of about 140 ms at the heart rate of about 64, and an image has a time resolution of about 185 ms at the heart rate of about 74. As described above, based on data on fluctuations in heart rate with time during the practice of holding breath, it is possible to estimate breath holding time during the collection of image data and the relationship between the heart rate and the time resolution of an image. These relationships are illustrated in FIG. 5, which is a time resolution graph showing estimated fluctuations in the time resolution of an image relative to the breath holding time. The heart rate may be omitted in FIG. 5.

[0028]As is evident from FIG. 5, the time resolution of an image greatly varies with the breath holding time. When successively obtained images greatly fluctuate in time resolution, a problem may occur in the analysis of an image. Thus in the example of FIG. 5, a preferable time resolution is expected to stably change in a range from 8.5 to 19.0 seconds (the heart rate of 74 to 80) of the breath holding time and the range is recommended for the collection of image data (hereinafter, will be referred to as a recommended range). In other words, the image data collection conditions are preferably set such that the collection of image data is started 8.5 seconds after the start of breath holding and the collection of image data is completed by 19.0 seconds after

the start of breath holding. Hence, in the present embodiment, the display 62 displays the time resolution graph of FIG. 5 and a recommended range marker R indicating the recommended range. Thus the operator can properly set the image data collection conditions with reference to the recommended range.

[0029]The recommended range may be automatically set by the CPU 52 according to a predetermined program. Alternatively, the range of time resolutions and the range of breath holding time may be set by the operator and the recommended range may be calculated according to the set range. The display of the recommended range is not limited to the example of FIG. 5. For example, the plot of the recommended range may be different from others in color, density, shape, size, and so on, or the plotted line of the recommended range may be displayed with a different color, density, width, and so on. Even when displaying only the time resolution graph on the display 62 without setting and displaying the recommended range, the operator can properly set the image data collection conditions with reference to the time resolution graph. A short breath holding time is preferable in consideration of the burden of the object 1. In some cases, the recommended range may be 22 to 30 seconds of the breath holding time in the example of FIG. 5.

[0030]In the case where image data is collected only within the recommended range, since an amount of data obtained at a time is limited, image data has to be repeatedly collected several times as described in S226 and S228 and the time of the scanning examination may be increased. However, an image with a preferable time resolution can be stably obtained in a well-planned way, and thus the exposure dose of the object 1 can be reduced.

[0031]When collecting image data on a plurality of parts of the object 1 while relatively moving the object table 24 and the scanner body 30 in the direction of the body axis, an elapsed time from the start time of image data collection varies with a distance from the starting position of image data collection on each part. The start time is the time when image data is collected on each part. In other words, image data on each part is collected at a different breath holding time, and thus images obtained on the respective parts have different time resolutions. Hence, in the present embodiment, the estimated time resolution of an image obtained on a part of the object 1 is clearly displayed as below:

[0032]FIG. 6 shows an example in which the projected image P of the object 1 in S212

and the time resolution graph G are superimposed on the screen of the display 62. In the time resolution graph G, fluctuations in estimated time resolution with time as described above are indicated on a coordinate system specified by the time axis and the temporal resolution axis. A start marker S indicates a planned start time of image data collection on the time resolution graph G and indicates a planned starting position of image data collection on the projected image P. In other words, image data collection is started at a time corresponding to the coordinates of the start marker S on the time axis of the time resolution graph G, and image data on a part of the object 1 is scheduled to be collected at that time, the part corresponding to the position of the start marker S on the projected image P. Similarly an end marker E indicates a planned end time of image data collection on the time resolution graph G and indicates a planned end position of image data collection on the image data collection position of the projected image P. With these markers, the relationship between a part where image data is collected on the object 1 and the breath holding time can be indicated. In this way, on the screen of the display 62, the positions of the projected image P and the origin of the time axis of the time resolution graph G and the direction and scale of the time axis are relatively adjusted, and the time resolution graph G and the position of image data collection on the projected image P are associated with each other, so that an estimated time resolution of an image obtained on a part of the object 1 can be clearly displayed.

[0033]Further, as shown in FIG. 6, an elapsed time from the start of breath holding to the start time of image data collection (ECG scanning delay after breath holding), a starting position of image data collection (ECG scanning starting position), and an end position of image data collection (ECG scanning end position) are preferably displayed on numerical display N according to the time resolution graph G and the positions of the start marker S and the end marker E.

[0034]The operator operates the operation part 64 to drag the start marker S and the end marker E which are displayed on the screen of the display 62. Thus the operator can move the start marker S and the end marker E relative to the projected image P and the time resolution graph G. The numerical display N is changed according to the movement. Further, the operator can directly change the numerical display N by operating the operation part 64. The start marker S and the end marker E are moved and displayed relative to the projected image P and the time resolution graph G according to the change.

[0035]In the example of FIG. 6, image data is scheduled to be collected around the upper end of the heart at 8.5 seconds of breath holding time. The best time resolution is expected at that time. This schedule is not changed even when the start marker S or the end marker E is moved. In the case of a particular image collection range like, for example, a part where coronary stenting is performed, it is particularly desirable that an image obtained in the image collection range have a preferable time resolution. Therefore, in the present embodiment, the image data collection conditions can be set so as to collect image data in the image collection range at a suitable time of image data collection. At that time, an estimated time resolution is in a suitable range.

[0036]In FIG. 7, an image collection range marker I indicates a suitable time of image data collection on the time resolution graph G and indicates a range of image data collection on the projected image P. In other words, at a time corresponding to the coordinates of the image collection range marker I on the time axis of the time resolution graph G, image data on a part of the object 1 is scheduled to be collected, the part corresponding to the position of the image collection range marker I on the projected image P. An image obtained from the data is expected to have a suitable time resolution. As shown in FIG. 6, a point indicating the best time resolution among points on the time resolution graph may be used as an image collection range marker and it is not particularly necessary to display the image collection range marker.

[0037]The operator drags, through the operation part 64, the time resolution graph G displayed on the screen of the display 62, so that the operator can move the time resolution graph G and the image range marker I relative to the projected image P. While the operator only sets an image collection range on the projected image P by pointing or the like through the operation part 64, the time resolution graph G and the image collection range marker I may be moved accordingly relative to the projected image P. Further, the operator can directly change the numerical display N indicating the position of an image collection range by operating the operation part 64. According to the change, the time resolution graph G and the image collection range marker I are moved and displayed relative to the projected image P. The image data collection marker S and the image data collection end marker E are moved according to the movement of the time resolution graph G and the image collection range marker I. As shown in FIG. 6, some of the markers may be selected and moved.

[0038]In the example of FIG. 7, the time resolution graph G and the image collection

range marker I are moved from the state of FIG. 6 without changing the position of the projected image P on the screen of the display 62. The projected image P may be moved without changing the positions of the time resolution graph G and the image collection range marker I on the screen of the display 62. In this case, the time resolution graph G and the image collection range marker I are fixed on the screen of the display 62, for example, at the center of the screen. When the operator drags the projected image P, scrolls the image, points an image collection range, and changes the numerical display N, the projected image P is moved and displayed relative to the time resolution graph G and the image collection range marker I.

[0039]In the example of FIG. 7, straight line I is displayed as the image collection range marker. The image collection range marker is not limited to a straight line. For example, the image collection range marker can be displayed as follows: a part expected to have a time resolution in a predetermined suitable range is displayed as a rectangle on the projected image P or the part is displayed with a different brightness or color from other parts. Although the image collection range marker I and the time resolution graph G are displayed in the example of FIG. 7, the display of the time resolution graph G may be omitted and only the image collection range marker may be displayed on the projected image P. Even in this case, it is possible to attain the purpose of the operator who wants to collect image data in the image collection range at the suitable time of image data collection.

[0040]In the examples of the time resolution graphs G shown in FIGS. 6 and 7, the breath holding start time is used as the origin of the time axis and the elapsed time of breath holding is used as time axis coordinates. The start time of image data collection may be used as the origin of the time axis and the elapsed time of image data collection may be used as time axis coordinates. The position of the origin of the temporal resolution axis and the direction and scale of the temporal resolution axis may be properly adjusted such that estimated fluctuations in time resolution with time can be easily read. For example, in FIGS. 5, 6 and 7, the time resolutions are used as temporal resolution axis coordinates. Thus as the number of numeric values increases in the direction of the temporal resolution axis, the time resolution decreases. In contrast, for example, when the reciprocals of time resolutions are used as temporal resolution axis coordinates, the time resolution improves as the number of numeric values increases in the direction of the temporal resolution axis.

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[0041]When image data is collected (S220), the CPU 52 controls the scanner 20 through the scanner control unit 54 such that image data is collected according the settings of the image data collection start time and image data collection starting position which are indicated by the image data collection start marker S and the image data collection end time and image data collection end position which are indicated by the image data collection end marker E. First, the position of the object table 24 is adjusted such that image data is collected on the image data collection starting position of the object 1 at the image data collection start time. For example, the image data collection starting position of the object 1 and the image data collection position of the scanner body 30 may be aligned with each other before the start of breath holding (S218) and after the start of breath holding, image data collection may be started at the image data collection start time and the movement of the object table 24 may be started. Further, the image data collection starting position of the object 1 and the image data collection position of the scanner body 30 may be aligned with each other at the image data collection start time by aligning, for example, a part of the object 1 and the image data collection position of the scanner body 30 before the start of breath holding, and starting the movement of the object table 24 at the breath holding start time. The part is indicated by a point indicating the breath holding start time on the time resolution graph G in FIG. 6 or 7.

[0042]During the collection of image data, the object table 24 is moved at a speed keeping the relationship between the elapsed time of breath holding and the image data collection target part shown in FIG. 6 or 7. Thus the image collection range of the object 1 matches with the image data collection position of the scanner body 30 at the suitable time of image data collection and the range becomes a target of image data collection. The image data collection end part of the object 1 matches with the image data collection position of the scanner body 30 at the image data collection end time. The image data collection is completed thus (S222).

[0043]In the above embodiment, the object 1 and the scanner body 30 are relatively moved during the collection of image data. Image data may be collected by non-helical scan in which the object 1 and the scanner body 30 are not relatively moved. In this case, the image data collection start marker S and the image data collection end marker E are not necessary. Before the start of breath holding, a part of the object 1 and the image data collection position of the scanner body 30 are aligned with each other. The part of the object 1 is indicated by the image collection range marker. After the start of breath

holding, image data is collected at a breath holding time indicated by the image collection range marker.

[0044]The method of moving the image data collection position of the scanner body 30 to change the image data collection part of the object 1 is not limited to the movement of the object table 24. The object table 24 may be fixed and the scanner body 30 may be moved. Alternatively, the image data collection position of the scanner body 30 may be moved.

[0045]In the above embodiment, fluctuations in heart rate when the object 1 holds his/her breath are analyzed. For example, fluctuations in heart rate are recorded when administering a medicine to the object 1 or stimulating the object 1, and fluctuations in heart rate and the time resolution of an obtained image at the administration of the medicine and the stimulation may be estimated during image data collection.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0046]

[FIG. 1]FIG. 1 is a schematic structural diagram showing an embodiment of an image data collection system according to the present invention;

[FIG. 2]FIG. 2 is a flowchart showing the flow of a series of cardiac area scanning examinations conducted by the image data collection system of FIG. 1;

[FIG. 3]FIG. 3 is a graph showing an example of fluctuations in the heart rate of an object to be examined with time after the start of practice of breath holding;

[FIG. 4]FIG. 4 is a graph showing the relationship among the time resolution of an image obtained by electrocardiographic synchronous scanning, image data collection conditions, and a heart rate;

[FIG. 5]FIG. 5 is a time resolution graph showing estimated fluctuations in the time resolution of an image relative to a breath holding elapsed time;

[FIG. 6]FIG. 6 is a diagram showing an example in which the projected image of the object and the time resolution graph are superimposed on the screen of a display; and

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[FIG. 7]FIG. 7 is a diagram showing an example in which the time resolution graph of FIG. 6 is moved and displayed.

[DESCRIPTION OF THE SYMBOLS]

[0047]

1 object , 10 image data collection system,20 scanner, 22 X-ray generator, 24 object table, 26 object table moving device , 28 X-ray detector, 30 scanner body, 32 scanner rotating device, 34 electrocardiographic electrode, 36 electrocardiographic data acquisition device, 50 controller, 52 CPU , 54 scanner control unit, 56 image processing unit, 58 electrocardiographic data processing unit , 60 data recorder, 62 display, 64 operation part, 66 bus, E image data collection end marker, G time resolution graph, I image collection range marker, N numerical display, P projected image, R recommended range marker, S image data collection start marker

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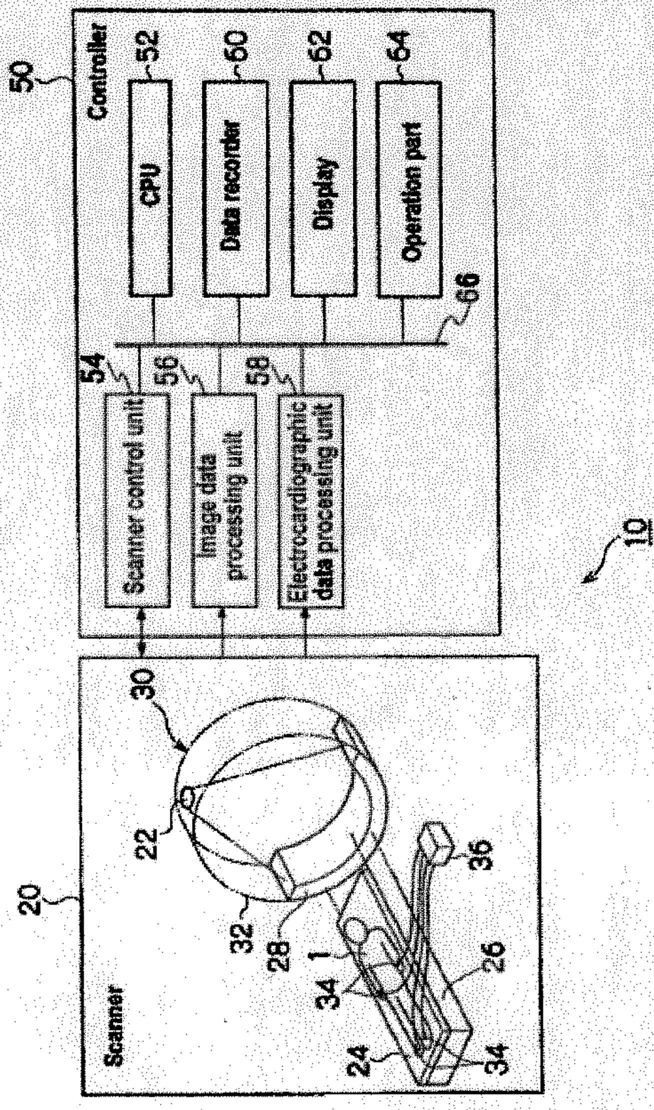
[DOCUMENT TITLE] DROWINGS

[FIG. 1]



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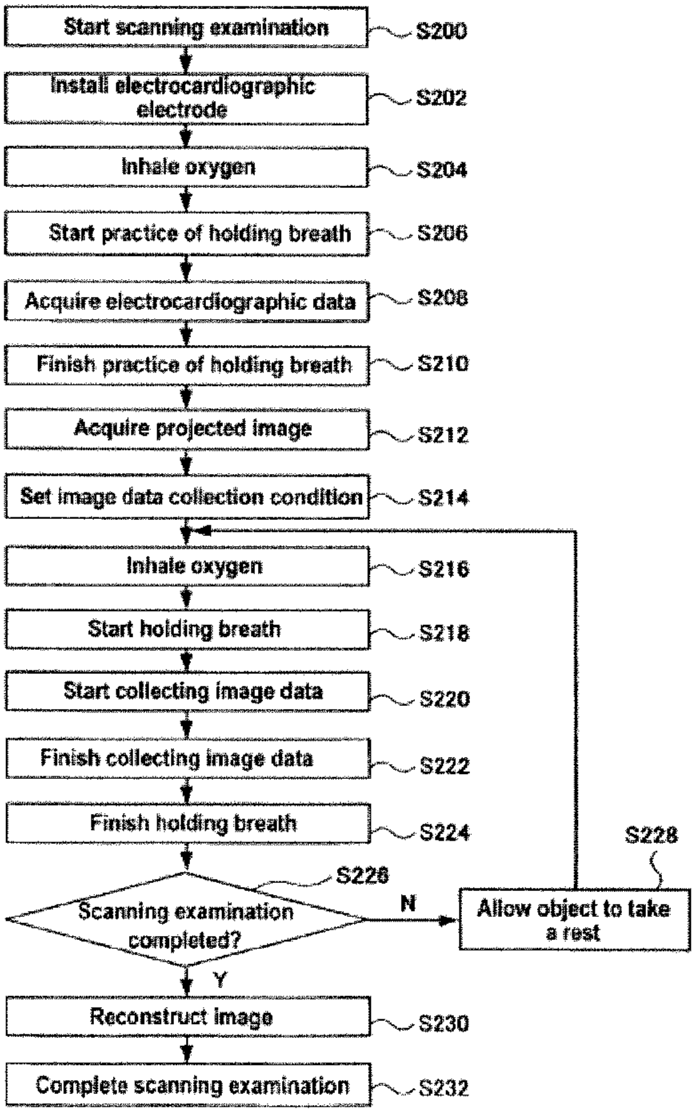
[FIG. 2]



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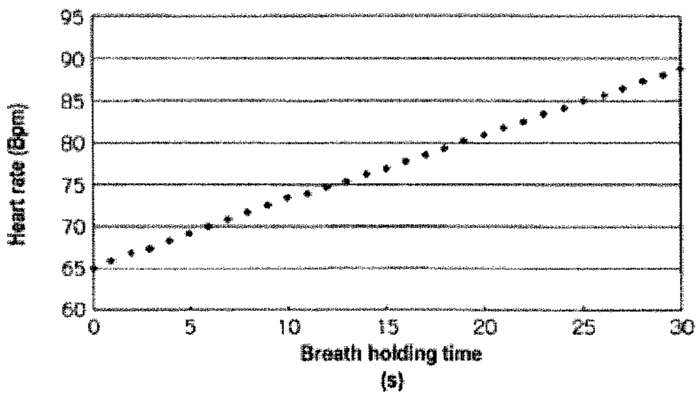
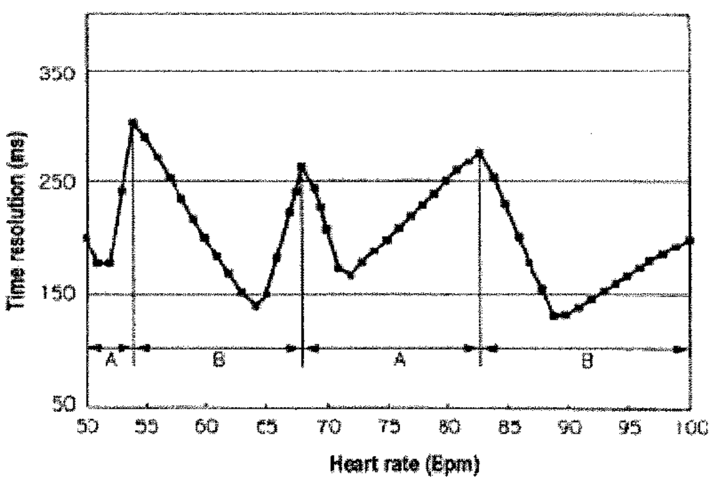
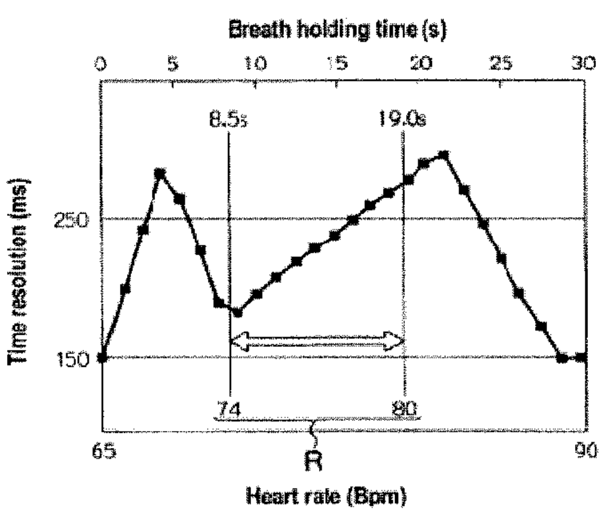
[FIG. 3]



[FIG. 4]

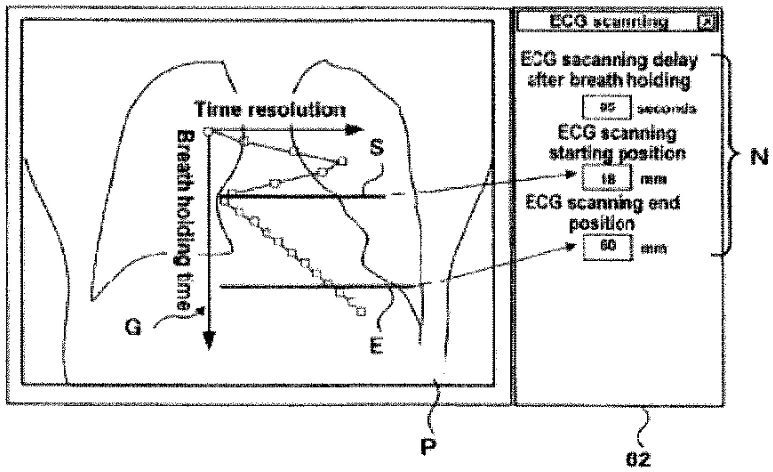


[FIG. 5]

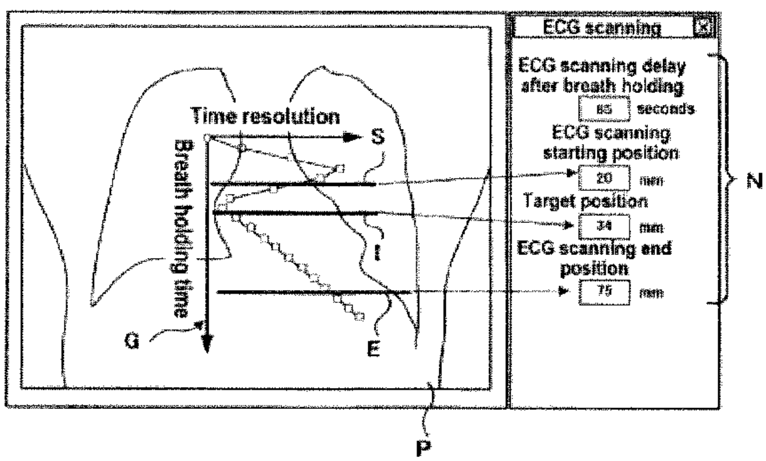


APPENDIX A

[FIG. 6]



[FIG. 7]



APPENDIX A

[DOCUMENT TITLE] Abstract

[Summary]

[Problems to be Solved] The present invention provides an image data collection system whereby preferable image data can be obtained even when the heart rate of an object to be examined fluctuates during the collection of image data.

[Means to Solve the Problems] The image data collection system is comprising: an image data collecting means configured to collect image data from an object to be examined, a heart rate recording means configured to measure a temporal change of heart rate of the object after a prescribed action and recording the measured heart rate, a resolution predicting means configured to predict a temporal change of resolution in the image data after the prescribed action based on the temporal change of heart rate recorded by the heart rate recording means, a site of interest designating means for designating a site of interest in the object; and an image data collection controlling means configured to adjust an image data collecting position of the image data collecting means to make the site of interest as a target of the image data collecting at a suitable time for collecting the image data when the time resolution predicted by the time resolution predicting means is in a desired range.

[Representative drawing] FIG.6